

ROGINSKIY, S. Z.

USSR/Kinetics. Combustion. Explosions. Topochemistry. Catalysis. B-9

Abs Jour : Ref Zhur - Khimiya, No 8, 1957, 26251

Author : S.Z. Roginskiy, T.I. Andriyanova

Title : Study of Redistribution of Hydrogen Among Hydrocarbons with Aluminosilicate Catalyst and Application of Carbon Isotope  $C^{14}$ .

Orig Pub : Zh. obshch. khimii, 1956, No 8, 2151-2155

Abstract : The redistribution of hydrogen (RH) among  $C_2H_4$  (I) and paraffins  $C_2H_6$  (II),  $n-C_4H_{10}$  (III) and  $n-C_8H_{18}$  (IV) in presence of an aluminosilicate catalyst in a circulating installation under atmospheric pressure was studied with the application of  $C^{14}$ . At the study of the reaction  $H_3C - C^{14}H_3 + H_2C = CH_2 \rightleftharpoons H_2C = C^{14}H_2 + H_3C - CH_3$  (1), the initial tagged hydrocarbon was II, and at the study of the reactions  $H_2C = C^{14}H_2 + n-C_4H_{10} \rightleftharpoons H_3C - C^{14}H_3 + n-C_4H_8$  (2) and  $H_2C = C^{14}H_2 + n-C_8H_{18} \rightleftharpoons H_3C - C^{14}H_3 + n-C_8H_{16}$  (3), the initial tagged hydrocarbon was I. The RH did not exceed 5.2% computed on the basis of the initial amount of II and did not practically depend on the temperature in the reaction (1) at 405 and 555° in case of mixtures of I and II in nearly equal volumes and the contact duration ( $\tau$ ) having been from 23.6 to 23.8 sec. It was established that II

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Abs Jour : Ref Zhur - Khimiya, No 8, 1957, 26251

was forming simultaneously from I in consequence of the RH between I and coke, 95% of which were forming from I and 5% from II. The reaction (2) proceeds slowly at 4050 and  $\tau = 21$  sec. in case the mixture consists of 54.4% of I and 45.6% of II, same the reaction (3) at 4050 and  $\tau = 9.4$  sec. in case the mixture consists of 46.9 mmols of I and 80 mmols of II. The amounts of tagged II produced at the experiments with the above mentioned mixtures were 13.4 and 12.3% of the initial amount of I respectively. The authors point out that the tagged II in the experiments with III and IV could be produced in the result of the RH between I and coke, but the applied method does not allow quantitatively to estimate the part of this reaction in the formation of II. It was found that the participation of paraffins in coke formation increased with the increase of the number of carbon atoms in the hydrocarbon molecule.

Card : 2/2

ROGINSKIY, S.Z.

Kinetic methods for the study of hydrogen exchange. Ukr.khim.zhur.  
22 no.1:24-33 '56. (MLRA 9:6)  
(Hydrogen)

ROGINSKIY, S. Z.

VESTNIK AKADEMII NAUK

Journal of the Academy of Sciences  
Vol 26, No. 3, March, 1956

51-PMF

Chemical Sciences Section, meeting held on December 13, 1955.

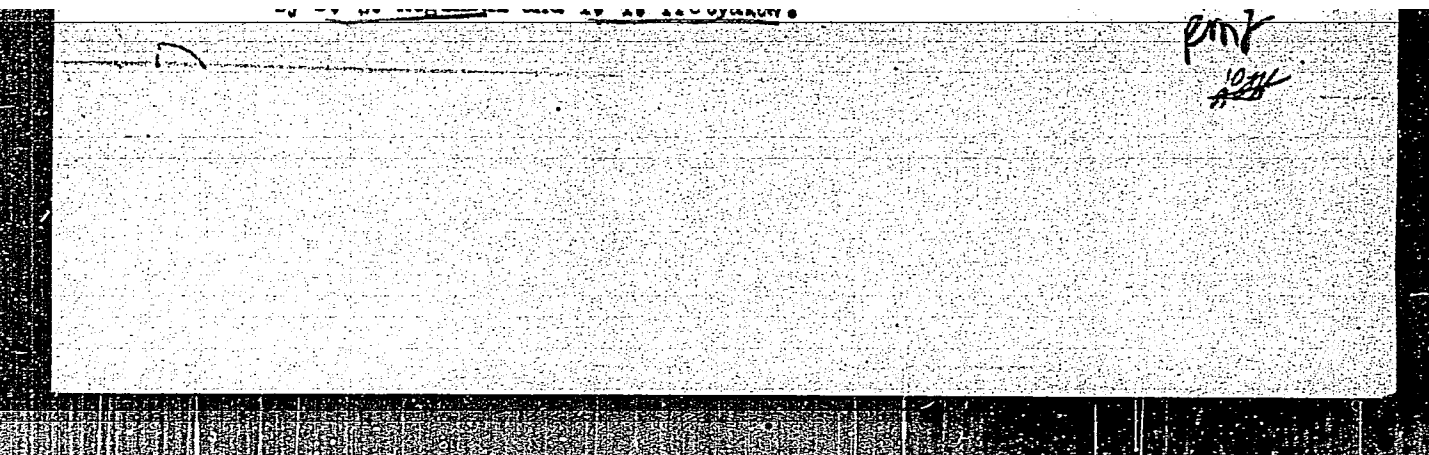
Brief Summaries are given of the following two papers read at that meeting: "Review of work on adsorption phenomena at the boundary

between metals and solutions applying radio-active isotopes", by A. N.

Frumkin; "Work on direct investigation of the topography and the kinetics of the chemical adsorption of individual molecules and their chemical transformations in metals".

"APPROVED FOR RELEASE: Tuesday, August 01, 2000

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APPROVED FOR RELEASE: Tuesday, August 01, 2000

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USSR/ Physical Chemistry - Kinetics. Combustion. Explosives. Topochemistry.  
Catalysis

B-9

Abs Jour : Referat Zhur - Khimiya, No 4, 1957, 11285

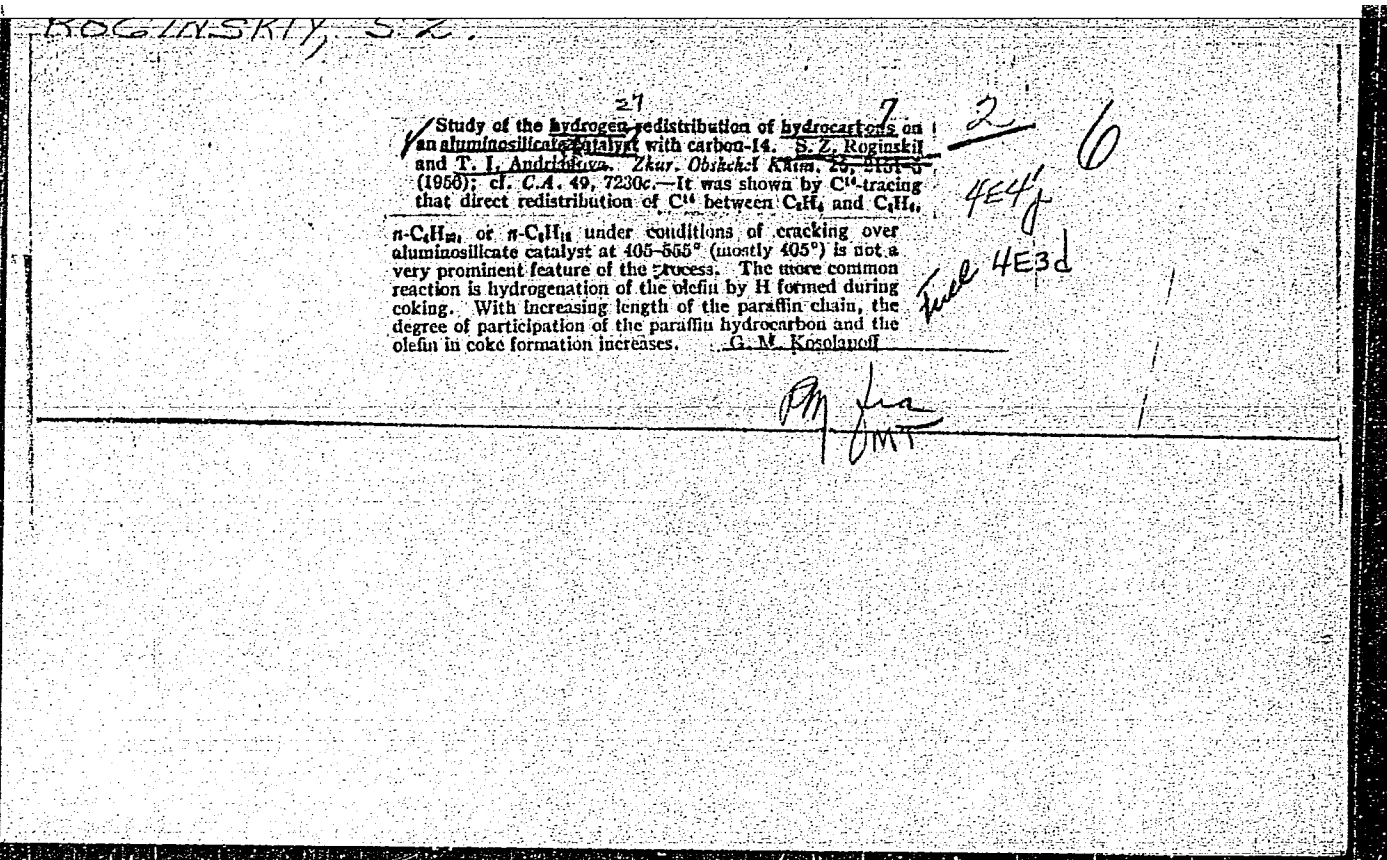
Author : Margolis L.Ya., Roginskiy S.Z., Gracheva T.A.

Title : Oxides of Transition Metals as Catalysts of Oxidation of Hydrocarbons

Orig Pub : Zh. obshch. khimii, 1956, 26, No 5, 1368-1371

Abstract : Under dynamic conditions a study was made of catalytic oxidation of propylene in mixtures of  $C_3H_6$  and  $O_2$ , of 1:1 composition, diluted with nitrogen, at 200-400°. The studied catalysts (C) are classified as follows: 1) C of extensive oxidation:  $MnO_2$ ,  $NiO$ ,  $MgCr_2O_4$ , yielding ~ 100%  $CO_2$  and  $H_2O$ ; 2) C of destructive oxidation:  $V_2O_{5-x}$ ,  $MoO_{3-x}$ ,  $WO_{3-x}$ ,  $UO_{3-x}$ , over which are formed, in addition to  $CO_2$  and  $H_2O$ , formaldehyde, acetaldehyde, formic and acetic acid; 3) C of selective oxidation to acrolein --  $Cu_2O$ , which produced at 400° a 60% yield of acrolein. It is assumed that active catalysts of extensive oxidation are oxides with incomplete d-shells, while active catalysts of mild oxidation can be catalysts of the type Ag and  $Cu_2O$ , in which gaps in the d-shell arise on modification of these C by oxygen.

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ROGINSKIY, S. Z.

USSR/Kinetics. Combustion. Explosions. Topochemistry. Catalysis. B-9

Abs Jour : Ref Zhur - Khimiya, No 8, 1957, 26254

Author : T.I. Andrianova, S.Z. Roginskiy

Title : Study of First Stages of Catalytic Cracking of Paraffins with Aluminosilicate Catalyst Influencing the Process by Little Additions.

Orig Pub : Zh. obshch. khimii, 1956, 26, No 9, 2418-2420

Abstract : The cracking of octane (I) on an aluminosilicate catalyst was studied at 518° and contact durations from 8.5 to 11.1 sec. and in presence of following additions:  $C_2H_4$  (II),  $C_8H_{16}$  (III),  $C_2H_5OH$  (IV)  $n-C_8H_{17}OH$  (V),  $n-C_{14}H_{29}OH$  (VI),  $(n-C_4H_9)_2O$  (VII),  $C_2H_5I$  (VIII) and  $C_8H_{17}OH$  (IX). Little additions (from 0.1 to 0.3%) of olefins, alcohols and ethers (II, III, IV, V, VI, and VII) noticeably (up to 23 - 37%) increase the transformation degree of I. Greater additions (up to whole values of mol.%) either act more weakly, or decelerate the cracking. Additions of about 0.5% of VIII or IX do not influence the depth of the transformation of I; an increase of the transformation depth of I is observed at the addition of about 4 mol.% of VIII or IX. Halogen acids in concentrations up to 6 mol.% do not

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USSR/Kinetics. Combustion. Explosions. Topochemistry. Catalysis. B-9

Abs Jour : Ref Zhur - Khimiya, No 8, 1957, 26254

influence the cracking of I. A preliminary treatment of the catalyst by acid vapors produces a little positive effect. In these experiments the authors see a confirmation of the participation of carbonium or radical ions in the process.

Card : 2/2

ROGINSKIY, S. L.

Study of the adsorption of simple gases on single metal crystals by means of a field emission microscope. S. L. Roginskii and I. I. Tret'yakov (Inst. Phys. Chem., Acad. Sci. U.S.S.R., Moscow). *Zhur. Fiz. Khim.* 30, 2330-40 (1956); cf. *C.A.* 50, 9122f. — Electron emission from a W needle of 0.2  $\mu$  diam. was lowered by H, O, or N at  $10^{-3}$  mm. Hg, but He had no effect. At  $10^{-2}$  mm. Hg and higher pressures, H, O, N, and A caused formation of strongly-emitting patches (up to 100 for  $10^3$  W atoms), which appeared and disappeared as a unit and probably represented the effect of single mols. adsorbed above a chemisorbed layer. The complex patches described by Becker and Brandes (*C.A.* 49, 14471e) and attributed to O, could be duplicated by anthracene vapor and are caused by org. impurities. — J. I. Bickerman.

pm mt

ROGINSKIY, S.Z.  
Electronics Semiconductors

G-3

Abs Jour : Ref Zhur - Fizika, No 3, 1957, No 7000

Author : Koyar, N.F., Roginskiy, S.Z., Cazonova, I.S.  
Title : Electronic Phenomena in Semiconductor Catalysis

Orig Pub : Dokl. AN SSSR, 1956, 106, No 5, 859-861

Abstract : To investigate the degree of localization of the action of impurities and the roles of the "remote effect" and strict periodicity of the lattice in the presence of electron-hole equilibrium, experiments were made in which cations, having the same charge as the cations of the basic material and not having the characteristic properties of a donor or acceptor were introduced into the catalyst-semiconductor. Binary solid oxides of nickel were the subject of the investigation.

The catalytic activity was measured under static conditions at low pressure in vacuum. The results obtained confirm the decisive significance of the size of the charge on the action of the cation introduced into the lattice.

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*Roginskiy, S. Z.*

USSR/Physical Chemistry - Surface Phenomena. Adsorption. Chromatography. Ion Exchange, B-13

Abst Journal: Referat Zhur - Khimiya, No 1, 1957, 562

Author: Tret'yakov, I. I., and Roginskiy, S. Z.

Institution: Academy of Sciences USSR

Title: On the True Nature of the Patterns of Individual Oxygen Molecules Described in the Work of Becker and Brandeis

Original

Periodical: Dokl. AN SSSR, 1956, Vol 107, No 6, 857-858

Abstract: It is shown that the double, quadruple, and more complex spots appearing on the screen of the electron microscope with a single-crystal tungsten point (Referat Zhur - Khimiya, 1956, 22130) are caused not by adsorbed oxygen or any other diatomic gas present in the system, but are apparently due to impurities which separate from the glass walls of the instrument.

Card 1/1

1100 HVS KTY 3-2

✓ Verification, by means of labeled alcohol, of the dehydra-  
tion-condensation mechanism of formation of the hydro-  
carbon chain in synthesis of hydrocarbons from carbon mon-  
oxide and hydrogen. O. A. Golovina, S. Z. Roginskii,  
M. M. Sakharov, and Ya. I. Elyus. Proc. Acad. Sci.  
U.S.S.R., Sect. Chem. 108, 228-31 (1960) (English trans-  
lation).—See C.A. 50, 14501d. B. M. R.

Chem

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PM

ROGINSKIY, S. Z.

USSR/Physical Chemistry - Kinetics, Combustion, Explosions, Topo-  
chemistry, Catalysis.

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Abs Jour: Referat. Zhurnal Khimiya, No 2, 1958, 3897.

Author : O.A. Golovina, S.Z. Roginskiy, M.M. Sakharov, Ya. T. Eydus.

Inst : Academy of Sciences of USSR.

Title : Checking Dehydration-Condensation Mechanism of Hydrocarbon  
Chain Formation at Hydrocarbon Synthesis of CO and H<sub>2</sub> by  
Tagged Alcohol.

Orig Pub: Dokl. AN SSSR, 1956, 108, No 2, 253-255.

Abstract: Hydrocarbon (HC) synthesis of CO and H<sub>2</sub> was carried out on  
Co catalyst at 195° with the addition of C<sub>2</sub>H<sub>5</sub>OH tagged with  
Cl<sup>14</sup> to the initial gas mixture. The drop of specific radio-  
activity (SR) with the increase of their molecule length and  
the stability of the molecular radioactivity SR in molecules  
containing over 5 C atoms was established. The revealed mole-  
cular radioactivity SR stability indicates a chain mechanism

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USSR/Physical Chemistry - Kinetics, Combustion, Explosions, Topo-  
chemistry, Catalysis.

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ABs Jour: Referat. Zhurnal Khimiya, No 2, 1958, 3897.

of the hydrocarbon molecule growth on the catalyst surface with the participation of alcohol in the initiation or breaking of flat growing chains. At the same time the authors are of the opinion that the data obtained by them, as well as the data of Kammer and Emmett (RZhKhim, 1954, 49641) are not enough to disprove the methylene scheme and to support the dehydration-condensation synthesis scheme promoted by Storek, Golambik and Anderson (Sintez uglevodorodov iz okisi ugleroda i vodoroda, Izd-vo inostr. literatury, M., 1954, 499).

Card : 2/2

-24-

KRYLOV, O.V.; ROGINSKIY, S.Z.; FROLOV, V.M.

Catalysis over semiconductors; the catalytic properties of  
metallic germanium. Dokl. AN SSSR 111 no.3:623-625 N '56.

(MLRA 10:2)

1. Chlen-korrespondent Akademii nauk SSSR. (for Roginskiy) 2.  
Institut fizicheskoy khimii Akademii nauk SSSR.  
(Germanium) (Catalysts)



ROGINSKIY, S. Z.

"New features of mechanism of catalysis obtained by means of isotopic data," a paper submitted at the International Conference on Radioisotopes in Scientific Research, Paris, 9-20 Sep 57.

ROGINSKIY, S Z -

PHASE I BOOK EXPLOITATION 1181

pp. 1, 2  
Akademiya nauk SSSR. Institut fizicheskoy khimii

Problemy kinetiki i kataliza. [t] IX: Izotopy v katalize (Problems of Kinetics and Catalysis. [v] 9: Isotopes in Catalysis) Moscow, Izd-vo AN SSSR, 1957. 442 p. 3,500 copies printed.

Eds: Roginskiy, S.Z., Vinogradova, O.M., Keyer, N.P. and Yanovskiy, M.I., Corresponding Members, USSR Academy of Sciences; Ed. of Publishing House: Vasserberg, V.E.

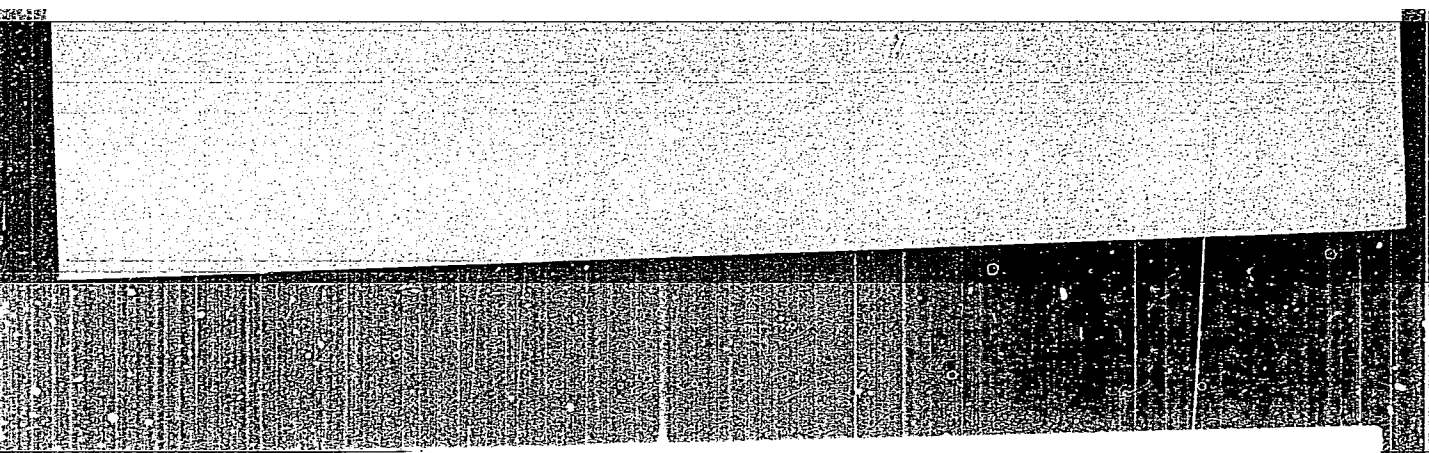
PURPOSE: This book is for specialists interested in the theoretical and practical problems of the application of isotopes in catalysis.

COVERAGE: This collection of articles forms volume 9 of "The Problems of Kinetics and Catalysis." Most of the papers were presented at the Conference on Isotopes in Catalysis which took place in Moscow, March 31 - April 5, 1956. Scientists from the Academy of Sciences of

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ROGINSKIY, S.Z.

KRYLOV, O.V.; ROGINSKIY, S.Z.; FOXINA, Ye.A.

Investigating the dependence of catalytic activity of binary metal compounds of the second group with nonmetals on the position of the elements in M.I.Mendeleev's periodic table. Report No.2: Catalytic decomposition of isopropyl alcohol on oxides of metals from the side subgroup of the second group. Izv.AN SSSR Otd.khim. nauk no.4:421-430 Ap '57. (MIRA 10:11)

1. Institut fizicheskoy khimii AN SSSR  
(Catalysis) (Isopropyl alcohol) (Oxides)

ROGINSKIY, S.Z.

Isotopes in catalysis. Probl. kin. i kat. 9:5-30 '57. (MIRA 11:3)  
(Catalysis) (Surface chemistry) (Isotopes)

*ROGINSKIY, S.Z.*  
GOLOVINA, O.A.; ROGINSKIY, S.Z.; SAKHAROV, M.M.; KYDUS, Ya.T.; DOKUKINA, Ye.S.

Function of straight chains in the synthesis of hydrocarbons from  
CO and H<sub>2</sub>. Probl. kin. i kat. 9:76-83 '57. (MIRA 11:3)  
(Hydrocarbons) (Carbon--Isotopes)

ROGINSKIY, S.Z.

Discussion. Probl. kin. i kat. 9:92-94 '57.

(MIRA 11:3)

(Catalysis) (Radioactive tracers)  
(Chemical reaction--Conditions and laws)

ROGINSKIY, S.Z.

MARGOLIS, L.Ya.; ROGINSKIY, S.Z.

Mechanism of catalytic oxidation of simplest unsaturated hydrocarbons  
on metals and semiconductors. Probl. kin. i kat. 9:107-116 '57.  
(Oxidation) (Hydrocarbons) (Catalysts) (MIRA 11:3)



ROGINSKIY, S.Z.

Discussion. Probl. kin. i kat. 9:140-141 '57.

(MIRA 11:3)

(Catalysts--Electric properties)

ROGINSKIY, S.Z.  
ANDRIANOVA, T.I.; ROGINSKIY, S.Z.

Alkane conversion on alumino silicate catalyst with aid of  $C^{14}$   
labeled molecules. Probl. kin. i kat. 9:152-161 '57. (MIRA 11:3)  
(Paraffins) (Catalysts) (Carbon--Isotopes)

~~ROGINSKIY, S.Z.~~

Discussion. Probl. kin. i kat. 9:168 '57.  
(Hydrogen--Isotopes) (Cracking process)

(MIRA 11:3)

ROGINSKIY, S.Z.  
VINOGRADOVA, O.M.; KEYSER, N.P.; ROGINSKIY, S.Z.

Using S.V. Lebedeva's method and radioactive carbon in the study of  
the mechanism of divinyl synthesis. Probl. kin. i kat. 9:175-186 '57.  
(Butadiene) (Catalysis) (Carbon--Isotope) (MIRA 11:3)

ROGINSKIY S.Z.  
BRIZHNEVA, N.Ye.; ROGINSKIY, S.Z.

Study of homogeneous catalytic bromination and isomerization of  
bromides by using radioactive bromine. Probl. kin. i kat. 9:201-  
214 '57. (MIRA 11:3)  
(Bromination) (Chemical reaction, Rate of) (Bromine--Isotopes)

ROGINSKIY, S.Z.; BRODSKIY, A.I.; VARSHAVSKIY, Ya.M.

Discussion. Probl. kin. i kat. 9:369-370 '57. (MIRA 11:3)  
(Chemical reaction, Rate of) (Isotopes)

ROGINSKIY, S.Z.

Main methods of chemical synthesis of substances with an unusual  
isotope composition. Probl. kin. i kat. 9:411-422 '57. (MIRA 11:3)  
(Radioactive substances) (Organic compounds)

ROGINSKIY S.Z.  
KRYLOVA, A.; ROGINSKIY, S.

Letters to the editor. Izv. AN SSSR Otd. khim. nauk no.10:1271  
0 '57. (MIRA 11:3)

1. Institute fizicheskoy khimii AN SSSR.  
(Catalysts) (Nitrogen--Isotopes)



Roginskiy, S.Z.

AUTHOR: Roginskiy, S.Z.

TITLE: Some Problems in Semiconductor Catalysis (Nekotoryye problemy poluprovodnikovogo kataliza)

PERIODICAL: Izvestiya Akademii Nauk SSSR, Vol. XXI, #2, pp 163-175  
1957, USSR, **Seriya fizicheskaya**

ABSTRACT:

Characteristic electronic properties of semiconductors have a direct bearing on their catalytic effect on chemical reactions.

Using the Riz' (7) classification, the following semiconductors are especially active:

1. Non-stoichiometric compounds with non-balanced valences,
2. Non-stoichiometric mixtures with semiconductivity controlled by valence,
3. Semiconductors with double valence.

It was previously considered as certain that in the catalysis of many reaction types a decisive role is

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TITLE:

Some Problems in Semiconductor Catalysis (Nekoto-ryye problemy poluprovodnikovogo kataliza)  
played by one of the elements, the constituents of the solid catalyzer, which has the incomplete electronic d-shell.

The problem was raised: are there any semiconductors which would be able to catalyze some chemical processes in spite of the absence of transient elements in their crystalline lattice? In order to solve this problem, the properties of "metallic" germanium, whose structure has no blanks in the d-shell, were investigated.

Positive results were obtained with alcohol dissociation. Methanol dissociates on the crystalline germanium powder already at a temperature of  $400^{\circ}\text{C}$ , that is at  $350^{\circ}$  lower than without germanium.

Germanium exerts a strong effect on dehydrogenation of isopropyl alcohol into acetone: at  $170^{\circ}\text{C}$  a total of 50% of isopropyl alcohol transforms into acetone during a half-an-hour.

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TITLE:

Some Problems in Semiconductor Catalysis (Nakoto-ryye problemy poluprovodnikovogo kataliza)

Germanium dioxide is considerably less active than germanium, which indicates that germanium itself acts as a catalyzer. It catalyzes also chemical dissociation processes of arsenic, germanium and antimony hydrides.

Sulfide, selenide and telluride of zinc are also active catalyzers for dehydrogenation of isopropyl alcohol, with activity increasing with the increase of metal atomic weight.

Some indications concerning significance of conductivity type on catalysis provides a comparative study of the admixtures' effect on catalytic activity of semiconductors possessing different types of conductivity with respect to one and the same reaction. Results of various researches are somewhat different, but the opposite effect of uni-valence and three-valence oxides and coincidence of sharp changes in conductivity with changes in catalytic activity were observed in all investigations. In the cases when solid solutions with n-conducting zinc oxide and p-conducting nickel oxide were studied, all investigators observed the opposite effect of the same

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TITLE:

Some Problems in Semiconductor Catalysis (Nekoto-ryye problemy poluprovodnikovogo kataliza)  
admixtures on catalytic properties of electron-type and hole-type semiconductors.

The author advanced (23) a microchemical conception of catalyzer activity, in which the main role in the formation of active surface was ascribed to admixtures and deviations from stoichiometry.

As a rule, an admixture activates the contact at its low content. After passing the maximum at some optimal content, the effect is sharply reduced at a further increase of content. These admixtures change in the first place the activation energy of a process. "Simbatno" (probably composed from the words "sym" = "syn" and "bath", i.e., at the same depth level - editor) with this energy changes also the logarithm of forexponential multiplier  $k_0$  in the equation of the constant of rate:

$$k = k_0 \exp (-E/RT).$$

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TITLE:

Some Problems in Semiconductor Catalysis (Nekoto-ryye problemy poluprovodnikovogokataliza)

$\lg k_0$  and  $E$  are connected linearly:  $\lg k_0 = \text{const} + \alpha E$ .

The effect of admixtures on NiO and ZnO shows that only substances considerably changing conductivity of the initial substance essentially affect their catalytic activities. These phenomena suggest that electric conductivity and catalytic activity are connected with the same structures. By correlating conductivity and catalytic activity for NiO and ZnO, the nature of structures causing modifications was cleared up. It turned out that the character of an admixture effect is determined basically by the charge value of the oxide introduced, but not by the size of these cations and other quantities.

A catalytic process is composed of a series of phases; one of the important phases is chemical adsorption. Some measurements show that adsorption is accompanied by the formation of a double elec layer with negative charge (positive is infrequent) with adsorbed

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TITLE:

Some Problems in Semiconductor Catalysis (Nekoto-ryye problemy poluprovodnikovogo kataliza)

molecules. The following mechanism can be proposed for the catalysis of oxidation: the process begins with the transfer of an electron to oxygen; the adsorbed ion-radical of oxygen  $O_2^-$  reacts with  $CO$ ,  $H_2$ , ethylene, etc., causing oxidation with the intermediate formation of peroxides. During one of the phases, the electron returns to the semiconductor restoring its elec neutrality. For the processes of this type n- and p-semiconductors cannot be equivalent.

Plane chains, whose probable role in catalysis was first pointed out by Semenov and Voyevodskiy (48), must have other mechanism than with homogenous gas reactions.

In the future, a new section of catalytic reactions kinetics will probably emerge, which will operate directly with electron processes in the border layer.

The method of molecular orbits applied by Koutecki (52) to chemical adsorption and catalysis seems to have a bright outlook.

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**TITLE:**

Some Problems in Semiconductor Catalysis (Nekotoryye problemy poluprovodnikovogo kataliza)

It is necessary to use jointly the zone semiconductor theory, the border layer theory and the molecular orbit method.

The article contains 7 figures. The bibliography lists 54 references, of which 32 are Slavic.

**INSTITUTION:**

Institute of Physical Chemistry of the USSR Academy of Sciences

**PRESENTED BY:**

**SUBMITTED:**

No date

**AVAILABLE:**

At the Library of Congress

Card 7/7

ROGINSKIY, S.Z.

AUTHORS:

Keyer, N.P., Roginskiy, S.Z. and Sazonova, I.S.

TITLE:

Investigation of Catalytic Properties of Solid Solutions containing Nickel Oxide (Issledovaniye kataliticheskikh svoystv tverdykh rastvorov na osnove zakisi nikelya)

PERIODICAL:

Izvestiya Akademii Nauk SSSR, Vol. XX1, #2, pp 183-191, 1957, USSR, *Seriya fizicheskaya*

ABSTRACT:

The Connection of electric conductivity with the kind of admixture is simple in some systems and when this is the case, conductivity can be regulated within a wide range.

The Institute of Physical Chemistry carried out a series of investigations with the oxidation of carbon monoxide on nickel oxide as a catalyzer. This investigation deals with catalytic properties of various solid solutions with nickel oxide, which differ by their electronic characteristics. Oxides of one-, two- and three-valence metals were dissolved in NiO,

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TITLE:

Investigation of Catalytic Properties of Solid Solutions containing Nickel Oxide (Issledovaniye kataliticheskikh svoystv tverdykh rastvorov na osnove zakisi nikelya)

and the correlation between the elec and catalytic properties of the catalyzer was studied. Nickel oxide and its solid solutions were obtained by roasting nickel carbonate or its mixtures with other salts for 2 hrs at a temperature of 900°C.

The change in electronic structure of solid solutions containing nickel oxide was concluded from the changes in specific elec conductivity. When  $\text{Li}_2\text{O}$  was dissolved in the nickel oxide, conductivity increased as a result of the decrease in activation energy of this process. The relation between temperature and conductivity in solid solutions containing nickel oxide with various ratios of lithium oxide is shown in Graph 1. The energy of conductivity activation varies linearly with the logarithm of lithium concentration (Graph 2).

Catalytic activity with respect to reaction of CO oxidation was studied in a vacuum.

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TITLE:

Investigation of Catalytic Properties of Solid Solutions containing Nickel Oxide (Issledovaniye kataliticheskikh svoystv tverdykh rastvorov na osnove zakisi nikelya)

The results of experiments have shown that the dissolving of lithium oxide leads to a considerable rise in activation energy and of the pre-exponential factor  $K_0$ . The dissolution of considerable quantities of bi-valence metal oxides does not affect the activation energy, but  $K_0$  is reduced by one order of magnitude. The dissolving of  $Fe_2O_3$  in  $N_2O$  decreases the oxidation rate by 2.5 times at the room temperature and by 9 times at  $300^\circ C$ . The results obtained differ somewhat from the results published by Paravano (8,9) and Schwab (7), the reason of divergence being not clear. There is nevertheless complete accordance with respect to two essential points:

1. High and contrasting effects of one- and three-valence metal oxides,
2. Sharp changes in the activation energy values.

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TITLE:

Investigation of Catalytic Properties of Solid Solutions containing Nickel Oxide (Issledovaniye kataliticheskikh svoystv tverdykh rastvorov na osnove zakisi nikelya)

The low sensitivity of the catalytic activity of nickel oxide to the ions of bi-valence metals being dissolved oxide cations on catalytic activity. This confirms the participation of catalyser electrons and holes in oxidizing catalysis.

6 Graphs and 3 Tables are included. There are 10 references, of which 4 are Slavic (Russian).

INSTITUTION: Institute of Physical Chemistry of the USSR Academy of Sciences

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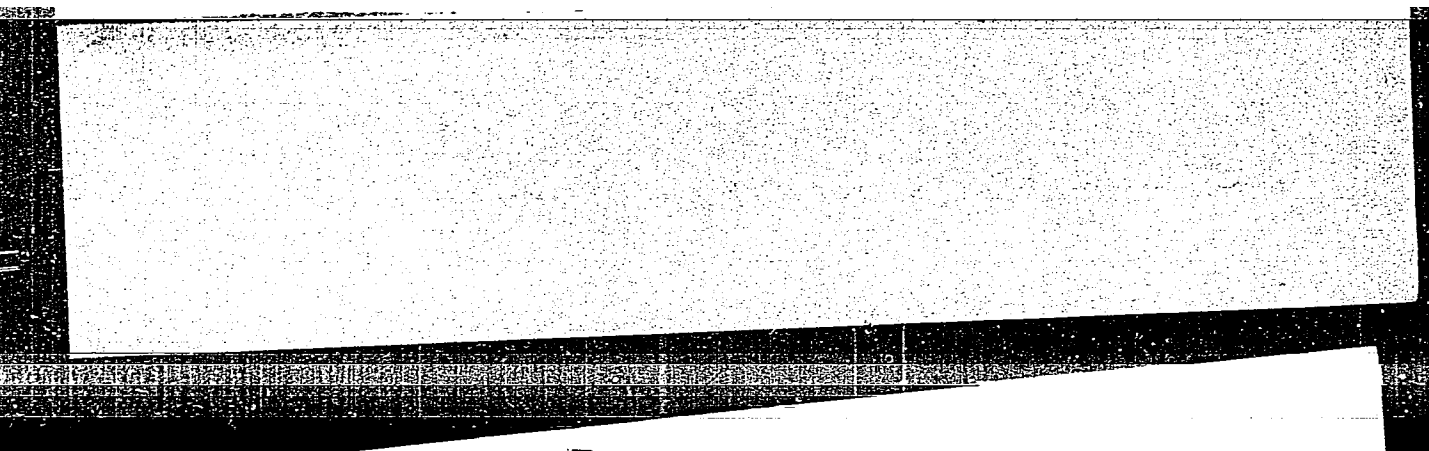
SUBMITTED: No date

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**"APPROVED FOR RELEASE: Tuesday, August 01, 2000**

**CIA-RDP86-00513R001445**



**APPROVED FOR RELEASE: Tuesday, August 01, 2000**

**CIA-RDP86-00513R0014451**

The Origin and Significance of the Variable Energetic  
Characteristics of a Catalytic Process

76-11-1/35

can be due to the heterogeneity of the direct interaction between the adsorbing molecules and by their interaction by the lattice.  
5.) In the case of an adsorption on an ideal-homogeneous surface and by the finite extension of active domains and lattice periodicity an inequivalent position of the adsorbed atoms is bound to develop at certain filling-up values and thus the hereby caused heterogeneity.  
6.) For the development of the catalysis theory methods are necessary with a unique limitation of the effects caused by heterogeneity and interaction, with differentiations of effects caused by these factors, and with a kind of function, which characterizes the heterogeneity and the repulsion in the case of a separate and simultaneous action of the effects. There are 7 figures and 15 references, 7 of which are Slavic.

ASSOCIATION: AN USSR, Physical-Chemical Institute, Moscow (Akademiya nauk SSSR, Institut fizicheskoy khimii, Moskva)

SUBMITTED: March 25, 1957

AVAILABLE: Library of Congress

Card 2/2

ROGINSKI, S. Z.

7 21  
 Catalysis on semiconductors. Catalytic properties of metallic germanium. O. V. Krylov, S. Z. Roginskii, and V. M. Frolov. *Doklady Akad. Nauk S.S.S.R.* 111, 623-5 (1957).—The catalyst was a cryst. Ge powder made by grinding a single crystal in an agate mortar weighing 2 g. and having an area of 200 sq. cm./g. A stoichiometric mixt. of  $2\text{H}_2 + \text{O}_2$  at a few min. pressure was led into the app. at 200–400°, and the water formed was condensed in a trap cooled with liquid  $\text{N}_2$ . The pressure dropped to  $\frac{1}{2}$  of the original value in the course of a few min. at 200°, and during a few sec. at 300°, which was, however, attributed to a selective adsorption of  $\text{O}_2$  on Ge.  $\text{CO} + \text{O}_2$  mixt. behaved similarly. Dehydration study of MeOH and  $\text{CH}_3\text{CHOHCH}_3$  showed that the MeOH dehydration began at a temp. 150° lower than without Ge, whereas the  $\text{CH}_3\text{CHOHCH}_3$  was dehydrated at a measurable velocity as low

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(temp. or by heating in H<sub>2</sub>. Considering the small size of the  
face, its activity was deemed high. W. M. Sternberg

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conf

S.Z. ROGINSKIY

B-9

USSR/Physical Chemistry - Kinetics, Combustion, Explosions,  
Topochemistry, Catalysis.

Abs Jour : Referat Zhur - Khimiya, No 1, 1958, 513

Author : O.M. Vinogradova, N.P. Keyer, S.Z. Roginskiy.

Inst : Academy of Sciences of USSR

Title : Study of Mechanism of Divinyl Synthesis by Method of S.V.  
Lebedev with Application of Radioactive Carbon.

Orig Pub : Dokl. AN SSSR, 1957, 112, No 6, 1075-1078

Abstract : The distribution of  $C^{14}$  in products of the catalytic syn-  
thesis according to Lebedev (at the addition of tagged mo-  
lecules of ethanol, acetaldehyde and crotonaldehyde)  
shows that the formation of divinyl from ethyl alcohol  
proceeds mainly through the condensation of acetaldehyde  
into crotonaldehyde, which, in presence of excessive etha-  
nol, transforms into crotyl alcohol in the result of the

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USSR/Physical Chemistry - Kinetics, Combustion, Explosions,  
Topochemistry, Catalysis.

B-9

Abs Jour : Ref Zhur - Khimiya, No 1, 1958, 513

redistribution of hydrogen. The dehydration of crotyl alcohol leads to the formation of divinyl. Divinyl is not forming at the ethanol reaction in the layer. A very rapid isotope exchange of  $\text{Cl}^{14}$  takes place between ethanol and acetaldehyde on the catalyst, which is a result of the intermolecular redistribution of hydrogen. The authors confirmed the fundamental order of stages of the Gorin-Kagan scheme.

Card 2/2

ZHABROVA, G.M.; SINITSYNA, M.D.; ROGINSKIY, S.Z.

Use of the emanation method in studying catalysts. Topochemical decomposition of magnesium and zinc carbonates and hydroxides. (MIRA 11:3)  
Dokl. AN SSSR 117 no.2:255-258 N '57.

1. Institut fizicheskoy khimii Akademii nauk SSSR. 2. Chlen-korrespondent AN SSSR (for Roginskiy).  
(Magnesium salts) (Zinc salts)

ROGINSKIY, S. Z.

The following papers were presented at the Annual Meeting of the German Chemical Society in Leipzig, 28 October - 1 November 1958:

BALANDIN, A. A. (AS USSR, Moscow)

"Toward the Construction of a Unified Theory of Catalysis - Structure and Energy Factors."

BORESKOV, G. K. (Physico-Chemical Inst. in Karpov, Moscow)

"Reciprocal Influence of Reagent Systems and Catalysts."

BRAUNSHTEYN, A. Ye. (Inst. of Biological and Medical Chemistry, AMB, USSR, Moscow)

"General Questions of Biological Catalysis in the Light of the Activity of the Pyridoxalenzyme."

EDMANDEL, E. (Inst. Chemical Physics, AS USSR, Moscow)

"Homogeneous Catalysis and Chemical Induction in Slow Oxidation - Chain Reaction."

ROGINSKIY, S. Z.

"Mechanism and Kinetics of the Half-Life Catalyst."

SHILOV, E. and YASHNEV, A. (Inst. Organic Chemistry, AS Ukrainian SSR)

"Mechanism of Catalytic Action of Aminoacids in the Reaction of Carbonyl Compounds."

VILENOV, P. and TROSHIN, A. (Physics Inst., Leningrad State University)

"Photoelectronic Emission on the Surface of Half-Life Catalysts."

SO: Chemische Technik, October 1958, Uncl.

ROGINSKIY, Z. S. Z. (Moscow)

"Mechanism and Kinetics of Seim-Conductor Catalysis," (Plenary lecture).

report submitted for Annual Meeting East German Chemical Society, 28 Oct -  
1 Nov 1958, Leipzig, G.D.R.

ROGINSKIY, S. Z.

"Adsorption of Various Gases on the Metal Point in the Electron Projector."

paper ~~plex~~ submitted for presentation at Fourth Int'l. Conference on Electron Microscopy, Berlin, GFR, 10-17 Sep 58.

Institute of Physical Chemistry, USSR Acad. Sci., Moscow.

C-3,800,829, 25 Jul 58.

ROGINSKIY, S. Z. (Inst. Phy. Chem. AS USSR)

"Horizontal Chains and Active Intermediate Forms of Heterogeneous Catalysis on the Basis of Isotopes." p. 42.

Isotopes and Radiation in Chemistry, Collection of papers of  
2nd All-Union Sci. Tech. Conf. on Use of Radioactive and Stable Isotopes and  
Radiation in National Economy and Science, Moscow, Izd-vo AN SSSR, 1958, 380pp.

This volume published the reports of the Chemistry Section of the  
2nd AU Sci Tech Conf on Use of Radioactive and Stable Isotopes and Radiation  
in Science and the National Economy, sponsored by Acad Sci USSR and Main  
Admin for Utilization of Atomic Energy under Council of Ministers USSR  
Moscow 4-12 Apr 1957.

ROGINSKIY, S.Z.

Conference on the physics and physical chemistry of catalysis.  
(MIRA 11:10)  
Khim. nauka i prom. 3 no.4:522-528 '58.

1.Chlen-korrespondent AN SSSR.  
(Catalysis--Congresses)

ROGINSKIY, S. Z.

SOV/30-58-7-34/49

AUTHOR: Krylov, O. V., Candidate of Chemical Sciences

TITLE: Physics and Physical Chemistry of Catalysis (Fizika i fiziko-khimiya kataliza) Transactions of the All-Union Conference (Vsesoyuznaya konferentsiya)

PERIODICAL: Vestnik Akademii nauk SSSR, 1958, Nr 7, pp. 119 - 122 (USSR)

ABSTRACT: This conference convened in Moscow between March 20<sup>th</sup> and March 23<sup>rd</sup>. It was called by the Department of Chemical Sciences and the Institute of Physical Chemistry of the AS USSR (Otdeleniye khimicheskikh nauk i Institut fizicheskoy khimii Akademii nauk SSSR). It was attended by more than 600 persons from different towns of the Soviet Union as well as from countries of the people's democracies. Nearly 100 reports were submitted, 78 of which were given to the participants for discussion. The remainder was read. The following reports were heard:

1) S. Z. Roginskiy, (Institute of Physical Chemistry, AS USSR), spoke about the selective methods concerning semiconductor catalysis.

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Physics and Physical Chemistry of Catalysis.  
Transactions of the All-Union Conference

SOV/ 30-58-7-34/49

- 2) V. V. Boldyrev, Tomsk University, used electron representations for the explanation of the course of topochemical reactions.
- 3) N. P. Keyyer, (Institute of Physical Chemistry, AS USSR), used electron representations for the clarification of the characteristics of heterogeneity of the active surface of semiconductor contacts.
- 4) F. F. Vol'kenshteyn, V. B. Sandomirskiy and Sh. M. Kogan, (Institute of Physical Chemistry, AS USSR), investigated the influence of exposure as well as of an external electric field on the absorptive power of a semiconductor.
- 5) A. N. Terenin spoke about the investigation of the structure and the behavior of surface formations in the case of adsorption and catalysis.
- 6) V. F. Kiselev (Moscow University), dealt with problems concerning the elementary act of catalysis.
- 7) G. K. Boreskov, Physical-Chemical Institute imeni L. Ya. Karpov (Fiziko-khimicheskiy institut im. L. Ya. Karpova), reported on the dependence of the catalytic activity of metals on their position in the periodic system of elements.

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Physics and Physical Chemistry of Catalysis.  
Transactions of the All-Union Conference

SOV/ 30-58-7-34/49

- 8) V. I. Bonch-Bruyevich and V. B. Glasko, (Moscow University), reported on the results of the adsorption computation of metals.
- 9) A. A. Balandin, Institute of Organic Chemistry AS USSR (Institut organicheskoy khimii Akademii nauk SSSR), reported on new data concerning the rôle played by structure factors in heterogeneous catalysis.
- 10) V. V. Voyevodskiy disproved his (and N. N. Semenov's) hypothesis of the existence of surface lattices and a heterogeneous catalysis.
- 11) Ya. T. Eydus and N. I. Yershov, (Institute of Organic Chemistry, AS USSR), O. A. Golovina, M. M. Sakharova, S. Z. Roginskiy and Ye. S. Dokukina, (Institute of Physical Chemistry, AS USSR), proved the existence of polymerization lattices in heterogeneous-catalytic processes of hydrocarbon synthesis.
- 12) N. N. Tikhomirov, P. N. Bubnov and V. V. Voyevodskiy, (Institute of Chemical Physics, AS USSR), reported on the application of the method of paramagnetic resonance of electrons for the purpose of investigating the interaction

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Physics and Physical Chemistry of Catalysis.  
Transactions of the All-Union Conference

SOV/ 30-58-7-34/49

- of molecular oxygen with the free carbon valences.
- 13) Ya. K. Syrkin, (Institute of General and Inorganic Chemistry AS USSR) (Institut obshchey i neorganicheskoy khimii Akademii nauk USSR), reported on problems concerning the molecular mechanism in catalysis.
  - 14) K. V. Topchiyev, Moscow University, gave a survey on the data concerning catalytic activity of aluminum silicates.
  - 15) L. I. Piguzova and M. A. Kaliko, All-Union Scientific Research Institute of Mineral Oil Industry (Vsesoyuznyy nauchno-issledovatel'skiy institut neftyanoy promyshlennosti) reported on problems concerning characteristics of active acid centers in cracking and in catalytic reactions with aluminum silicates.
  - 16) N. M. Chirkov, Institute of Chemical Physics, AS USSR, proved the proton character of the mechanism of homogeneous acid catalysis.
  - 17) O. V. Krylov, Institute of Chemical Physics, AS USSR, spoke about the heterogeneous catalysis of acids.
  - 18) G. M. Zhabrova, V. I. Vladimirova and Ye. I. Yegorov, Institute of Physical Chemistry, AS USSR, spoke about the sorption of ions in the production of a zinc oxide catalyst.

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Physics and Physical Chemistry of Catalysis.  
Transactions of the All-Union Conference

SOV/ 30-58-7-34/49

19) O. M. Poltorak, Moscow University, reported on problems concerning the genesis of catalysts.

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76-32-4-1/43

AUTHOR: Roginskiy, S. Z.

TITLE: Isotopic Methods for Studying the Heterogeneity of Active Surfaces and Interactions in the Adsorption Layer ( Izotopnyye metody izucheniya neodnorodnosti aktivnykh poverkhnostey i vzaimodeystviya v adsorbtsionnom sloye)

PERIODICAL: Zhurnal Fizicheskoy Khimii, 1958, Vol. 32, Nr 4, pp. 737 - 745 (USSR)

ABSTRACT: In this paper a group of examination methods by using isotopes is described, which has been worked out for studying the change of thermic effects and activation energy in connection with the biographic heterogeneity of surface, the counter-action of absorbed molecules and the change of chemical composition of the contact. Starting from a certain consideration in 1945/46 together with O. M. Todes, the differential isotope method of direct observation of the surface heterogeneity has been suggested. The experimental work began, but no critical observations have been carried out so far. The principle of the differential isotope methods is that on the surface to be tested two or more portions with different isotope contents are

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76-32-4-1/43

Isotopic Methods for Studying the Heterogeneity of Active Surfaces and Interactions in the Adsorption Layer

adsorbed and - also in portions - removed again. The difference in homogeneous and heterogeneous surfaces leads to a change in the isotope composition of the removed portion, caused by the thermodynamic and kinetic isotope effect. Whether the effect has a positive or negative sign does, in homogeneous surfaces, not depend on the order of adsorption of portions of different isotope compositions. Two graphs of determinations in homogeneous and heterogeneous surfaces are given. This method permits determinations of surface heterogeneity on a number of semiconductors, metal, activated carbon, but has a number of disadvantages marking it a primarily qualitative determination method, unless a number of improvements are made, as an increased number of removed portions. In considering the kinetic isotope methods of determination of heterogeneity and the distribution function among others a sketch is given to show the order of application of portions in the isotope exchange (E) on heterogeneous and homogeneous surfaces. It

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Isotopic Methods for Studying the Heterogeneity of Active Surfaces and Interactions in the Adsorption Layer

follows that in the first case first an exchange of portions with a minimal  $E$  and at the end with a maximal  $E$  takes place, while in the second case the full exchange with constant  $E$  takes places and, energetically, the molecules remain identical. This phenomenon in heterogeneous surfaces was utilised by Eischens (Reference 6) in the analyses of the synthesis of ammonia. Other examples and possibilities for further development are stated. In case a summary of the data leads to a loss of energetic heterogeneity of surface (change of adsorption heat and activation energy in the adsorbing layer) approximations for the function of the counter action energy of the molecular distance from the surface can be derived from the function of  $Q$  and  $E$  of the filling, as well as from equations and graphs of adsorption equilibrium and adsorption kinetics. Repulsion can also be analysed by using the isotope method, here a certain part of the surface is filled with a marked quantity of the sorptive and consequently analysed. For this

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Isotopic Methods for Studying the Heterogeneity of Active Surfaces and Interactions in the Adsorption Layer

purpose microwave spectra as well as the normal Raman spectra can serve. In conclusion it is stated that in the systems considered so far heterogeneity predominates against counteraction. There are 8 figures and 8 references, 7 of which are Soviet.

ASSOCIATION: Akademiya nauk SSSR, Institut fizicheskoy khimii, Moskva  
(AS USSR Institute for Physical Chemistry, Moscow)

SUBMITTED: March 23, 1957

AVAILABLE: Library of Congress

1. Surfaces--Adsorptive properties
2. Adsorption--Measurement
3. Isotopes--Applications
4. Raman Spectroscopy--Applications
5. Microwave spectra--Applications

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AUTHORS:

*ROGINSKIY, SZ.*  
Krylov, O. V., Roginskiy, S. Z. Corresponding  
Member AN USSR

20-3-30/59

TITLE:

Catalysis on Intrinsic Semiconductors (O katalize na  
poluprovodnikakh v oblasti sobstvennoy provodimosti)

PERIODICAL:

Doklady AN SSSR, 1958, Vol. 118, Nr 3, pp. 523-525 (USSR)

ABSTRACT:

Although the same mechanism of the primary act of the interaction of a semiconductor-catalyst with the substrate prevails the catalysis in the domain of intrinsic conduction must differ in many regards from the catalysis in the domain of the admixture-conduction. For the catalysis in the domain of intrinsic conduction the following must be characteristic: 1) A light dependence of the catalytic activity on the "structure-sensitive" properties; 2) A connection between the catalytic properties and the substance properties and the width of the forbidden zone, which results from this; 4) High values of the factor in front of the exponential function; 5) A compensation of the differences between the n- and the p-semiconductors. The data which were obtained by the authors

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20-3-30/59

# Catalysis on Intrinsic Semiconductors

together with Ye. A. Fokina are given in a table, they show the sharp increase of the catalytic activity with regard to the dehydration of the isopropyl-alcohol at the transition from ZnO to ZnTe. At the same time the activation energy of the dehydration decreased, whereby this activation energy depends much on the filling up. The rate of dehydration was low, in case of all catalysts, whereby the percentage of dehydration decreased at the transition from ZnO to ZnTe. When the other properties in the series  $\text{ZnO} \rightarrow \text{ZnS} \rightarrow \text{ZnSe} \rightarrow \text{ZnTe}$  were investigated the following could be stated: The catalytic activity and the dielectric constant  $\epsilon$  increase, but the difference of the electron negativity and the width of the forbidden zone decrease. An exception in this view is ZnO with  $U = 3,2$  eV. The catalysis takes place in a temperature range, in which are at least 3 of the here examined binary compounds (ZnS, ZnSe, and ZnTe) in the domain of intrinsic conduction. At the same time with the increasing of the dehydrating activity the lattice parameter of the ZnS increases. Thus in the case of the here examined binary compounds a simpler correlation between the width of the forbidden zone and the catalytic activity is observed. Such investigations would be desirable also for other groups

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Catalysis on Intrinsic Semiconductors

20-3-30/59

of compounds. There are 1 figure and 19 references, 15 of which are Slavic.

ASSOCIATION: Institute for Physical Chemistry AN USSR (Institut fizicheskoy khimii Akademii nauk SSSR)

SUBMITTED: September 9, 1957

AVAILABLE: Library of Congress

Card 3/3

20-118-4-28/61

AUTHORS:

Sinyak, Yu. Ye., Roginskiy, S. Z., Corresponding  
Member of the AS USSR, Yanovskiy, M. I.

TITLE:

The Isotopic Exchange of Carbon Dioxide Chemically Adsorbed  
on an Iron Catalyst in the Synthesis of Ammonia (Izotopnyy  
obmen CO<sub>2</sub>, khemosorbirovannoy na zheleznom katalizatore  
sintezy ammiaka)

PERIODICAL:

Doklady AN SSSR, 1958, Vol. 118, Nr 4, pp. 727-730 (USSR)

ABSTRACT:

The catalytic synthesis from nitrogen and hydrogen at an iron catalyst with aluminum- and potassium additions has already often been studied. The nature of the accelerating effect of these additions has hitherto remained unexplained. The second author emphasized in a previous work (reference 2) the exploitation of the velocity measurements of the isotopic exchange between the atoms of the surface and the gases. The kinetic isotopic method has a number of advantages, compared to the former methods (references 1,3-5) suggested for the study of the heterogeneity. If it is used, the probability of a redistribution of molecules decreases and all measurements are carried out with an unchanged filling of the surface, which

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The Isotopic Exchange of Carbon Dioxide Chemically Adsorbed on an Iron Catalyst in the Synthesis of Ammonia 20-118-4-28/61

is essential. The exchange velocity of chemically adsorbed carbon monoxide at the same catalyst has already been studied (reference 6). The velocity constant of the exchange decreased gradually in these experiments which cannot be explained by the influence of the interaction. The iron catalyst was double-activated, reduced, and passivated outside of the reaction system. Active carbonic acid was produced from  $\text{BaC}^{14}\text{O}_3$  and  $\text{H}_2\text{SO}_4$  of 96%. The inactive carbonic acid was formed in a pyrolytic decomposition of  $\text{Na}_2\text{CO}_3$ . Figure 1 gives a scheme of the experimental plant. The lower curves of figure 2 show that adsorbed  $\text{CO}_2$  in an atmosphere of  $\text{CO}$ ,  $\text{H}_2$ , and  $\text{Ar}$  at a pressure of 500 mm torr. is not desorbed. In the case of presence of  $\text{CO}_2$  in the plant a quick rise of the activity is observed in the gas phase. After the equilibrium had been reached  $\text{CO}_2$  was freeze-dried out in a calibrated container (figure 1,4) which was fitted out with an end-counter MST-17. Then the total activity ( $A_{\text{IAust}} = A_{\text{Iobm}}$ ) of the  $\text{CO}_2$  was determined. It was found that  $A_{\text{IAust}}$  forms a quantity of approximately 40-50% of the total quantity of the adsorbed  $\text{C}^{14}\text{O}_2$ . Then an equal quantity

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The Isotopic Exchange of Carbon Dioxide Chemically Adsorbed on an Iron Catalyst in the Synthesis of Ammonia 20-118-4-28/61

of inactive  $\text{CO}_2$  was introduced into the catalyst. The activity (A<sub>IIAust</sub>) in the gas phase increased unimportantly. This operation was carried out a second time. No rise of the activity (A<sub>IIIAust</sub>) was found in the gas phase. Then the reactor was heated up to 475°C. Thus an activity appears in the gas phase which amounts to approximately 20% of the total activity which was absorbed by the contact. Only the introduction of hydrogen at 475°C into the circulation makes possible the second experimentla series. The trained catalyst had to absorb a certain quantity of inactive  $\text{CO}_2$  and then a strictly dosed quantity of active  $\text{C}^{14}\text{O}_2$ . Then the kinetic experiment was carried out. In the second experiment an equal quantity of  $\text{C}^{14}\text{O}_2$  was absorbed by the catalyst immediately after the draining and then the curve of the isotopic exchange was recorded (figure 3). Hence follows that the exchange percentage depends on the sequence of the absorption. If  $\text{C}^{14}\text{O}_2$  is absorbed first, the

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The Isotopic Exchange of Carbon Dioxide Chemically Adsorbed on an Iron Catalyst in the Synthesis of Ammonia 20-118-4-28/61

exchange portion is lower by 15-20% than in the case of a reverse sequence. Figure 4 shows the exchange velocity of CO<sub>2</sub> in experiments in which first 2,85 cm<sup>3</sup> of inactive CO<sub>2</sub> and only 0.42 ml of active C<sup>14</sup>O<sub>2</sub> act on the catalyst. In this case the exchange portion amounts to approximately 60-65%. The given data point to the existence of two sections which differ according to their properties sharply from one another and are characteristic of the alkaline part of the surface of the catalyst. The exchange mechanism is apparently approximated to that of carbonate-alkaline and alkaline-earth elements (reference 8). There are 4 figures, and 8 references, 5 of which are Soviet.

SUBMITTED: July 25, 1957  
AVAILABLE: Library of Congress

Card 4/4

5(4)

AUTHORS:

Roginskiy, S. Z. Corresponding Member, Academy of Sciences,  
USSR, Yanovskiy, M. I., Zhabrova, G. M., Vinogradova, O. M.,  
Kadenatsi, B. M., Markova, Z. A. SOV/20-121-4-28/54

TITLE:

A Catalytic Synthesis of Unsaturated Hydrocarbons of the Series  
 $C_4$ , Labelled by the Radioactive Carbon  $C^{14}$ , With the Use of  
Vapor Phase Distributive X-Ray Chromatography (Kataliticheskiy  
sintez nepredel'nykh uglevodorodov ryada  $C_4$ , mekhonnykh  
radiouglerodom  $C^{14}$ , s ispol'zovaniyem parofaznoy raspredelitel'-  
noy radiokhromatografii)

PERIODICAL:

Doklady Akademii nauk SSSR, 1958, Vol 121, Nr 4, pp 674-677  
(USSR)

ABSTRACT:

This paper reports on the results of the production of labelled  
unsaturated hydrocarbons on the basis of ethyl alcohol  
labelled by  $C^{14}$ . It is a peculiarity of this method that  
all the labelled molecules are produced simultaneously by  
the same catalytic process which develops under the influence  
of S. V. Lebedev's catalyst for the synthesis of divinyl.

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A Catalytic Synthesis of Unsaturated Hydrocarbons of the Series  $C_4$  Labelled by the Radioactive Carbon  $C^{14}$ , With the Use of Vapor Phase Distributive X-Ray Chromatography SOV/20-121-4-28/54

This paper discusses a special case of the general principle of the synthesis of labelled molecules. This principle consists of the carrying out of a group synthesis (which gives a mixture of some substances with an unusual isotopic composition) and of the subsequent application of physical-chemical separation methods. Especially interesting is the separation of the labelled hydrocarbons of the  $C_4$  series with various degrees of saturation and with various structural-isomeric shapes. Such hydrocarbons are butadiene (divinyl),  $\alpha$ -butylene,  $\beta$ -butylene (cis-variant),  $\beta$ -butylene (trans-variant). The catalytic synthesis was carried out by means of S. V. Lebedev's catalyst at  $390^\circ$ . A labelled ethyl alcohol  $C^{14}H_3C^{14}H_2OH$  with the specific radioactivity 0.724 Curie/ml was used for the synthesis. The chromatographic separation of the marked gaseous labelled products is then discussed. A figure shows a typical chromatogram of the mixture of the gaseous radioactive products of the synthesis of divinyl from

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A Catalytic Synthesis of Unsaturated Hydrocarbons of the Series  $C_4$ , Labelled  
by the Radioactive Carbon  $C^{14}$ , With the Use of Vapor Phase Distributive  
X-Ray Chromatography

SOV/20-121-4-28/54

the labelled alcohol ( $C_2^{14}H_5OH$ ). According to this chromatogram, the main gaseous product is divinyl (81,3 %). The percentage of butylene is not higher than 4,7 %. The composition of the products may be changed by a heat treatment of the catalyst. The specific activities of the hydrocarbons have approximately the same values. In order to identify the individual fractions, their infrared absorption spectra were taken; they are shown by a figure. The combination of chromatography with rectification, extraction and with a counter-flow distribution is very promising. These methods are very productive and may be used for the preliminary group separation of a mixture into some fractions with a subsequent extraction of the individual components. The catalytic experiment takes 1 hour and the chromatographic separation - 2 - 2,5 hours. There are 4 figures and 9 references, 7 of which are Soviet.

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- A Catalytic Synthesis of Unsaturated Hydrocarbons of the Series  $C_4$  , Labelled by the Radioactive Carbon  $C^{14}$  , With the Use of Vapor Phase Distributive X-Ray Chromatography

ASSOCIATION: Institute fizicheskoy khimii Akademii nauk SSSR  
(Institute of Physical Chemistry, AS USSR)

SUBMITTED: April 16, 1958

Card 4/4

5(4)

AUTHORS:

Krylov, O. V., Roginskiy, S. Z.

SOV/62-59-1-3/38

TITLE:

The Dependence of Catalytic Activity of Binary Compounds of Metals of the Second Group With Non-Metals on the Position of Elements in Mendeleyev's Periodic System (Izucheniye zavisimosti kataliticheskoy aktivnosti binarnykh soyedineniy metallov vtoroy gruppy s nemetallami ot polozheniya elementov v periodicheskoy sisteme Mendeleyeva) Communication V. Regularities in the Change of Properties of the Series ZnO, ZnS, ZnSe, ZnTe (Soobshcheniye 5. O zakonmernostyakh izmeneniya svoystv v ryadu ZnO, ZnS, ZnSe, ZnTe)

PERIODICAL:

Izvestiya Akademii nauk SSSR. Otdeleniye khimicheskikh nauk, 1959, Nr 1, pp 17 - 24 (USSR)

ABSTRACT:

The connection between the position of elements within the solid body in the periodic system on the one hand and the catalytic properties of this body on the other hand is insufficiently investigated. Systematic papers hitherto published primarily refer to simple bodies and mainly deal with explaining the role played by empty points of d-shells of the atom in catalysis. In view of the development of

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Elements in Mendeleyev's Periodic System. Communication V. Regularities in the Change of Properties of the Series ZnO, ZnS, ZnSe, ZnTe

APPROVED FOR RELEASE: Tuesday, August 01, 2000

CIA-RDP86-00513R001445

semiconductor chemistry and the connection between the catalytic and electric properties, which frequently has been observed, it seemed to be important to investigate the effect exercised by the non-metallic component upon the latter. Nor have there been any experimental data available which might serve as basis for generalizations. In some earlier papers the authors tried to fill this gap by investigating the catalytic properties of semiconductors. The results obtained and data recently published indicate certain regularities which in future might be of general importance. In the present paper the authors investigated the effect of non-metal referring to the compound of the type  $A^{II}B^{VI}$  with zinc as a positively charged atom  $A^{II}$ . In order to determine the corresponding regularities they compared the change in the catalytic properties in the series  $ZnO \rightarrow ZnS \rightarrow ZnSe \rightarrow ZnTe$  as to the decomposition of isopropyl alcohol with the changes of a number of electric

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The Dependence of Catalytic Activity of Binary Compounds of Metals **of the Second** Group With Non-Metals on the Position of Elements in Mendeleyev's Periodic System. Communication V. Regularities in the Change of Properties of the Series ZnO, ZnS, ZnSe, ZnTe SOV/62-59-1-3/38

characteristics of these semiconductors. It was stated that the catalytic activity of the binary MeX compound changes as to the dehydrogenation of alcohol simultaneously with the change of binding polarity which becomes manifest by the change of a number of electric properties. On the increase of the atomic weight of the non-metal in the MeX compound the activation energy of the dehydrogenation of alcohol decreases, whereas dielectric constant increases, and the width of the danger zone as well as the difference of electronegativity decreases. The dependence is complicated by the change of E (activation energy) with the occupation of the surface. According to data of publications it was assumed that the catalysts ZnS, ZnSe, ZnTe (possibly also ZnO) primarily act within the range of their own conductivity. Definite conclusions can be drawn only when electric properties of semiconductors during catalysis have been measured. It is supposed that the position of the level of impurity conductivity may be also determined according to the

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The Dependence of Catalytic Activity of Binary Compounds of Metals of the Second Group With Non-Metals on the Position of Elements in Mendeleev's Periodic System. Communication V. Regularities in the Change of Properties of the Series ZnO, ZnS, ZnSe, ZnTe SOV/62-59-1-3/38

position of elements (of which the semiconductor is made up) in the periodic system. The authors thank F. F. Vol'kenshteyn and V. B. Sandomirskiy for the discussion. There are 1 table and 31 references, 20 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: May 31, 1957

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5(4)  
AUTHORS: Sinitsyna, M. D., Zhabrova, G. M., Roginskiy, S. Z.,  
Gordeyeva, V. A. SOV/62-59-1-35/38

TITLE: Emanating Capacity in Topochemical Processes as a Typical  
Feature of the Specific Surface (Emaniruyushchaya sposobnost'  
pri topokhimicheskikh protsessakh kak kharakteristika  
udel'noy poverkhnosti)

PERIODICAL: Izvestiya Akademii nauk SSSR. Otdeleniye khimicheskikh nauk,  
1959, Nr 1, pp 176 - 178 (USSR)

ABSTRACT: In order to investigate the changes of the structure and  
specific surface in topochemical processes the authors  
applied the method of emanation. Radiothorium nitrate  
solution was used as emanation source. The advantage of  
radiothorium in comparison to the previously used radium  
(Ref 1) consists in the fact that it forms thoron in syste-  
matic transformation. Since thoron has only a short half-  
life measurements can be carried on without interruption  
(Refs 1 and 2). In the investigation of magnesium hydroxide  
and magnesium oxide samples it was found that there is a  
linear dependence of the emanation coefficient (measured

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at room temperature) on the size of the specific surface. This dependence apparently holds also for other systems. It indicates that the determination of the emanation coefficient can be substituted for comparatively difficult and complicated measurements of sorption. First a calibration curve would have to be plotted for each system, however, according to several points determined by experiments: emanation coefficient - specific surface. There are 1 figure and 5 references, 2 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: June 28, 1958

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5(4)

SOV/62-59-4-4/42

AUTHOR:

Roginskiy, S. Z.  
larities

TITLE:

Regu- in the Selection of Catalysts (Zakonomernosti podbora katalizatorov). Communication 2. On Physical and Physico-chemical Catalysis (Soobshcheniye 2. O fizicheskom i fiziko-khimicheskom katalize)

PERIODICAL:

Izvestiya Akademii nauk SSSR. Otdeleniye khimicheskikh nauk, 1959, Nr 4, pp 586-595 (USSR)

ABSTRACT:

In the present paper it is shown that physical and physico-chemical catalysis is possible beside the common or chemical catalysis. To solve various problems it appears suitable to group the reactions and catalysts according to various kinetic, phase-chemical, and structural characteristics. The classification into three main groups - physical, chemical, and physico-chemical catalysis (Table 1) - cannot, however, be considered final because there are combined and limit cases which cannot be clearly assigned to one of the three main groups. Any chemical process involves in addition to the actual chemical transformation a supply of energy to the reacting molecules and a dissipation of energy from the reaction products. The action of

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larities  
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foreign substances on this energy process brings about various catalytic effects, which according to their nature should be described as energy catalysis. The acceleration of the reaction during the molecular-kinetic catalysis is due to the change in the molecular-kinetic conditions of the reaction process. In processes which involve only a small activation energy and in which the active particles generate independently, the reaction can be appreciably accelerated by the introduction into the gas of a developed solid surface having an appropriate adsorption potential. This process is described by the author as cohesion catalysis. Physical catalysis includes, of course, the numerous variants of catalysis which are due to a change in the contact conditions and of dispersion. Of the four groups mentioned here the first is the closest approach to physical catalysis in the kind of the change in the reacting molecule and owing to its low specificity. All transitions from a purely physical to a purely chemical catalysis occur in the second and third groups. The reactions of the fourth group are nearer to chemical than to physical catalysis. There are 2 tables and 18 references, 10 of

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larities  
Regu-/ in the Selection of Catalysts. Communication 2. On Physical and Physico-  
chemical Catalysis

which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of  
Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: July 10, 1957

Card 3/3

ROGINSKIY, S.Z.

Study of the mechanism of chemical processes by means of isotopes.  
Khim.nauka i prom. 4 no.4:479-486 '59. (MIRA 13:8)

1. Chlen-korrespondent Akademii nauk SSSR.  
(Chemical reactions) (Radioactive tracers)

5(4)

AUTHORS:

Isayev, O. V., Margolis, L. Ya.,  
Roginskiy, S. Z.

SOV/79-29-5-26/75

TITLE:

Catalytic Oxidation of Propylene in Acrolein. 1  
(Kataliticheskoye okisleniye propilena v akrolein. 1)

PERIODICAL:

Zhurnal obshchey khimii, 1959, Vol 29, Nr 5, pp 1522-1527 (USSR)

ABSTRACT:

In the present paper the properties of the cuprous oxide catalyst which was used in the catalytic oxidation of propylene in acrolein were investigated. Further its activity was compared with other oxidizing contacts. In order to clarify the part acetaldehyde plays in the oxidation of propylene the method of the marked atoms was used. The oxidation of the propylene mixture with oxygen and with acetaldehyde marked with radioactive carbon (1 : 2 : 0.5) on cuprous oxide at 350° permitted the definition of the genetic compounds of these reaction products. The results of a typical experiment are illustrated in figure 1. As can be seen, the carbon dioxide is mainly not formed from acetaldehyde but independently via other intermediates. The data devised according to the kinetic method of M. B. Neyman (Ref 5) are given in figure 2. By the use of radioactive carbon it could be proved that in these processes at the

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Catalytic Oxidation of Propylene in Acrolein. 1

SOV/79-29-5-26/75

same time and independently of one another several parallel reactions take place, in which connection unstable intermediates of the peroxide type are formed. Further some experiments were carried out in which the effect of the contact time upon the oxidation process of propylene was investigated (Fig 3). The acrolein yield first increases on prolonged contact time but later remains constant whereas the yield of carbon dioxide continuously increases. During the oxidation of propylene on the copper catalyst the acrolein is not completely destroyed. Probably at the same time and independently two reactions take place: The formation of acrolein and its oxidation up to the carbon dioxide. The rate ratio of this process is determined by the composition of the gas mixture. In order to clarify the dependence of the acrolein yield on the concentration of the catalyst on the carrier, several samples of the catalyst on pumice and carborundum were investigated (Figs 4-7). The investigation indicated that the selectivity of the process can be obtained by shortening of the contact time, by increase of the linear velocity of current as well as by a decrease of the copper concentration on the carrier which determines the course of the process in the kinetic range. Under certain conditions the length of the catalyst layer can be of decisive importance: Further the

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Catalytic Oxidation of Propylene in Acrolein. 1

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oxidation of propylene on other catalysts was investigated:  $V_2O_5$ ,  $MoO_3$ ,  $WO_3$ ,  $Cr_2O_3$ ,  $CdTe$ ,  $CuSe$ ,  $CuTe$ ,  $Cu_3As$ . Selenide, telluride, arsenide and cuprous oxide were found to have the highest selectivity with respect to the formation of acrolein. On the formation of the mixture of saturated aldehydes and acrolein, oxides of transition metals ( $MoO_3$ ,  $V_2O_5$  etc.) are especially active. There are 7 figures and 6 references, 5 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR  
(Institute of Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: April 22, 1958

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SOV/76-33-11-12/47

5(4)  
AUTHORS:

Golovina, O. A., Sakharov, M. M., Roginskiy, S. Z.,  
Dokukina, Ye. S.

TITLE:

Isotopic Data on the Part Played by Two-dimensional Chains in  
the Synthesis of Hydrocarbons From Carbon Monoxide and Hydrogen

PERIODICAL:

Zhurnal fizicheskoy khimii, 1959, Vol 33, Nr 11, pp 2451-2456  
(USSR)

ABSTRACT:

The problem of hydrocarbon chains, which completely develop  
on the surface of the catalyst, has not yet been solved.  
N. N. Semenov and V. V. Voyevodskiy (Ref 3) recently carried  
out investigations on this subject. A direct proof of the  
existence of two-dimensional chains in the synthesis of hydro-  
carbons was obtained by the experiments of Emmett, Kummer et  
al. (Ref 8), who regard the results obtained as a confirmation  
of the dehydration-condensation synthesis scheme according to  
Storch, Golambik, and Anderson (Ref 7). However, the paper  
mentioned in reference 8 has given no answer to many important  
questions. Therefore the distribution of radioactivity among  
the hydrocarbon synthesized from CO and H<sub>2</sub> on cobalt-thorium  
catalysts (100 Co : 18 ThO<sub>2</sub> : 100 kieselguhr) has been in-

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vestigated. In one series of these experiments ethylene and propylene labeled with  $C^{14}$  were added to the initial mixture. In the other case, the catalyst was carbonized with labeled carbon monoxide. It was found that ethylene at a concentration of 4.8 vol% in the original mixture participates both in the formation reaction and in the growth reactions of the hydrocarbon chains, as has been observed by Ya. T. Eydu and N. D. Zelinskiy et al (Ref 12) in the case of higher concentrations. Like ethylene, also propylene and carbon carbide are able to participate in the growth of hydrocarbon chains. It is assumed that the participation of carbon carbide depends on a previous exchange of the latter for carbon monoxide. The authors present a four-stage scheme for the formation of hydrocarbons from CO and  $H_2$  on a cobalt-thorium catalyst in the case of initiation of the process by ethyl molecules. There are 3 figures and 15 references, 11 of which are Soviet.

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Akademiya nauk SSSR, Institut fizicheskoy khimii, Moskva

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Isotopic Data on the Part Played by Two-dimensional Chains in the Synthesis  
of Hydrocarbons From Carbon Monoxide and Hydrogen

(Academy of Sciences, USSR, Institute of Physical Chemistry,  
Moscow) ✓

Card 3/3

5(4)

AUTHORS:

SOV/20-124-2-32/71  
Zhabrova, G. M., Sinitsyna, M. D., Roginskiy, S. Z., Corresponding Member, AS USSR

TITLE:

The Application of the Emanation Method in the Investigation of Catalysts (Primeneniye emanatsionnogo metoda k issledovaniyu katalizatorov)

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 2, pp 354-357 (USSR)

ABSTRACT:

The authors first mention some previous papers on this subject. It is of interest to investigate one of the previously investigated systems in detail by applying radioactive thorium. The magnesium hydroxide used in these experiments was prepared by precipitation from solutions of magnesium nitrate and alkali followed by careful washing with distilled water. A solution of 0.36 g  $\text{ThO}_2$ /ml (radioactive thorium) in nitric acid was used as a source of emanation. The authors determined the kinetic curves for the time dependence of the emanating power in the course of the dehydration of magnesium hydroxide at the temperatures 320; 350; 400; 450; 550; 600; 700; 800; and 1080°. At

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the same time, the percentage of the conversion of hydroxide into oxide was determined. A continuous increase of the emanating power with time is observed at the temperatures of 320° and 350°. The liberation of thoron becomes much slower towards the end of dehydration. The continuous character of the time dependence of radioactivity is disturbed already at a dehydration temperature of 400°, i.e. there is a flat maximum which corresponds to 75% of conversion. At 450° there is already a clear maximum which corresponds to 70-80% of conversion. A further increase in dehydration temperature continues to increase the sharpness of the maximum. The characteristic shape of the kinetic curves for the time dependence of the emanating power is caused by the simultaneous effect of dehydration and thermal sintering. The second diagram shows the curves for the dependence of the emanation coefficient and of the specific surface on the dehydration temperature of magnesium hydroxide. Both these quantities have a maximum at 450° after which they decrease. The emanating coefficient measured at the temperature of the topochemical process must be described by more complicated functions. The thoron generated seems to

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be eliminated only from the superficial layer of the samples of hydroxide and magnesium oxide investigated. There are 3 figures, 1 table, and 7 references, 4 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: September 24, 1958

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5(4)

AUTHORS:

Yenikeyev, E. Kh., Margolis, L. Ya., SOV/20-124-3-32/67  
Roginskiy, S. Z., Corresponding Member, AS USSR

TITLE:

The Charge of the Surface of Oxide Semiconductors as a  
Result of the Adsorption of Gases and Vapors (Zaryazheniye  
poverkhnosti okisnykh poluprovodnikov pri adsorbtsii gazov i  
parov)

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 3, pp 606-608  
(USSR)

ABSTRACT:

A sensitive method of determining a surface charge is that by  
measuring the work function. For the purpose of investigating  
the connection between surface charge and adsorption, the  
authors used a vibrating condenser. The immobile condenser  
plate consisted of the pulverulent semiconductor to be  
investigated, and the vibrating condenser plate was a gold  
plate. The adsorption of  $O_2$ ,  $H_2$ ,  $CO$ ,  $CO_2$ ,  $C_3H_6$  and of  
isopropyl-alcohol vapors on  $ZnO$ ,  $V_2O_5$ ,  $CuO$  and  $NiO$  were  
investigated.  $ZnO$  and  $V_2O_5$  are electron semiconductors,  
 $CuO$  and  $NiO$  are hole-semiconductors. These samples were heated

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as a Result of the Adsorption of Gases and Vapors

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in a continuously maintained vacuum up to  $\sim 10^{-6}$  mm to temperatures 250-400°. A diagram shows the dependence of the contact potential  $V_k$  of NiO on the length of time used for treating the sample which was later in an oxygen atmosphere. The considerable reduction of the work function is apparently due to the desorption of the oxygen from the surface of the catalyst. The semiconductors, which had formerly been subjected to the influence of an  $O_2$  atmosphere, can be compared with one another with respect to the work function only if the samples are treated in a fully homogeneous manner. After an approximately continuous value of the contact potential has been attained, the adsorption of various gases and vapors was investigated at room temperature and at increased temperatures. The table given below contains data concerning the surface charge of oxide semiconductors in the case of the adsorption of gases (at 20°):

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semiconductor	adsorbed gas				
	O <sub>2</sub>	H <sub>2</sub>	CO	CO <sub>2</sub>	C <sub>3</sub> H <sub>6</sub>
CuO	-	not adsorbed	+	not changed	+
NiO	-	not adsorbed	+	not changed	+
V <sub>2</sub> O <sub>5</sub>	-	+	+	not changed	+
ZnO	-	not adsorbed	not ads.	not changed	not changed

All adsorbed gases (with the exception of oxygen) diminish either the work function (i. e. they occur as electron donors irrespective of the type of semiconductor), or they do not vary the work function. In this case adsorption is very rapid, and at 80° these gases are nearly completely desorbed; in this case physical adsorption probably occurs. This conclusion is confirmed in the case of the adsorption of C<sub>3</sub>H<sub>6</sub> on CuO, and in this case a rapid irreversible adsorption is observed. The work function decreases considerably. Oxygen is adsorbed firmly and irreversibly on NiO (20°), in which case it increases the work

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The Charge of the Surface of Oxide Semiconductors  
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function considerably. In the adsorption of vapors of isopropyl-alcohol on ZnO at 20° the contact potential passes through a maximum (and the work function passes through a minimum), if the surface of the adsorbent is filled with alcohol up to 10%. Measurement of the potential difference at the places of contact is a promising method of investigating the character of the binding of the molecule adsorbed on the surface of the semiconductor. There are 4 figures, 1 table, and 5 references, 3 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: August 14, 1958

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5(4)

AUTHORS:

Popov, V. I., Roginskiy, S. Z.,  
Corresponding Member, AS USSR

SOV/20-124-6-26/55

TITLE:

The Kinetic Isotope Effect of the Oxidation of Hydrogen on  
Platinum (Kineticheskiy izotopnyy effekt okisleniya vodoroda  
na platine)

PERIODICAL:

Doklady Akademii nauk SSSR, 1959, Vol 124, Nr 6, pp 1275-1278  
(USSR)

ABSTRACT:

The present paper deals with the kinetic isotope effect mentioned in the title in the case of a large surplus of hydrogen. This reaction was chosen because of the lack of by-reactions, and also because this reaction can be investigated within a wide temperature interval (beginning from temperatures of less than 0° C). Besides, several earlier papers are available which deal with this subject. First, carrying out of the experiments and the apparatus used are described. The reaction occurred under dynamic conditions in a completely soldered glass apparatus, smooth platinum being used as catalyst. In this way complications connected with porosity were avoided. The kinetic isotope effect of hydrogen was measured at 95° and the results obtained by

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The Kinetic Isotope Effect of the Oxidation of  
Hydrogen on Platinum

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these experiments are given by a table. During the catalytic oxidation of hydrogen the water hereby produced is enriched with protium and for the separation coefficient  $\alpha$  the value  $\alpha = 1.31$  with  $\Delta\alpha = \pm 3\%$  was found. In the case of the irreversible reaction of a substance consisting of 2 nucleides, and if there is no distorting influence of an isotope exchange, the reaction may be imagined to be composed of 2 independent reactions. In the case under investigation (with a low content of deuterium in the hydrogen) this practically means that  $H_2 + (1/2)O_2 = H_2O$ ,  $HD + (1/2)O_2 = HDO$ . Each of these two processes comprises the diffusion of hydrogen toward the surface and the following stages, which may begin with the adsorption of  $H_2$  or also with its reactions in the case of an impact against the adsorbing oxygen. These processes may eventually end by the desorption of water and its diffusion from the surface layer into the current of gas. Similar considerations apply also to the control of the diffusion of water (formed in the case of an oxidation) from the surface

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layer of the catalyst into the gas current. A much more complicated problem is the control of the catalytic oxidation of hydrogen by chemical stages or by adsorption stages. There are 1 figure, 1 table, and 9 references, 4 of which are Soviet.

ASSOCIATION: Institut fizicheskoy khimii Akademii nauk SSSR (Institute of  
Physical Chemistry of the Academy of Sciences, USSR)

SUBMITTED: December 2, 1958

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